

### REMARKS

Applicant graciously acknowledges the statement that claims 7-9 and 13-14 are allowed. No claims have been amended. No new matter has been included. Claims 1-14 are now pending in this application.

Claims 1-6 and 10-12 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Applicant's admitted prior art ("AAPA") of this application in combination with Tsukamoto (U.S. Patent No. 5,047,818). The rejection is respectfully traversed.

The present invention relates to a pixel cell with a gate controlled charge storage region. The present invention provides a gate controlled buried channel to obtain efficient charge transfer from the photodiode through a transistor gate as a shutter to the charge storage region where charge is stored until the charge is transferred to a sensing node, all with low charge loss. Claims 1 and 11 each recite a pixel cell comprising, *inter alia*, "a photo-conversion device that generates charge" and "a gate controlled charge storage region that stores the charge under control of a control gate."

As agreed by the Examiner, the AAPA fails to teach or suggest "a gate controlled charge storage region that stores the charge under control of a control gate," as recited by claims 1 and 11. AAPA simply teaches a typical pixel cell having an electronic shutter, which includes a shutter transistor and a storage device. Although AAPA does teach the use of a storage device, it does not teach or suggest the use of "a control gate," in conjunction with the storage region. The control gate increases the charge transfer efficiency and maintains minimal charge loss. To overcome these deficiencies, the Office Action suggests the combination of the AAPA with Tsukamoto.

Tsukamoto relates to a memory device. Tsukamoto, at column 1, lines 11-15, teaches that a P<sup>+</sup> region, deep under the N<sup>+</sup> region 7 and below a P region 12, suppresses collection of the  $\alpha$  ray induced carriers into the N<sup>+</sup> region 7 without causing bad influences on the read/write transistor. Tsukamoto at column 3, lines 28-39

The Office Action asserts that it would have been obvious to one of ordinary skill in the art to incorporate Tsukamoto's memory cell charge storage region in the AAPA pixel circuit. First, Tsukamoto does not relate to pixel cells, but relates to a memory device. Therefore, Tsukamoto cannot teach transferring a charge within a pixel cell from a photodiode to a charge storage region through a transistor and storing the charge in a charge storage region of a pixel being controlled by a control gate. Indeed, Tsukamoto does not address any problem attributed to a pixel of an imager device and, as such, one of ordinary skill in the art would not have been motivated to combine the teachings of the Tsukamoto memory device with the pixel device in AAPA in the manner suggested by the Examiner. In essence, the Examiner has used the present specification as a roadmap attempting to construct the claimed invention from the cited references based on hindsight.

The Examiner states that one of ordinary skill in the art would have been motivated to combine AAPA and Tsukamoto to "prevent soft errors caused in the charge storage capacitor." Office Action at 2. Tsukamoto's teachings relate to a memory device which incorporates a capacitor. Tsukamoto teaches that the structure of the P-type layer 101 reduces soft errors in the capacitor, which translates into the erroneous storage of a "1" or "0" digital logic state. Tsukamoto at column 3, lines 40-44. Soft errors is not a problem in imagers, which store analog signals representing integrated charge. The claimed invention is designed to improve the charge transfer of electrons corresponding to an image, whereas Tsukamoto is designed to store voltages

representing 1s and 0s. Tsukamoto simply does not teach how one skilled in the art could modify the AAPA to provide a pixel cell with an electrical shutter having improved charge transfer efficiency and minimal charge loss. As a result, there is no motivation evidenced in the references to suggest combining these teachings to achieve the claimed invention. Those of ordinary skill in the art would not have been so motivated.

Accordingly, AAPA in combination with Tsukamoto fails to establish a *prima facie* case of obviousness. For at least the reasons set forth above as well as others, Applicant respectfully requests that the rejection be withdrawn.

In view of the above amendment, Applicant believes the pending application is in condition for allowance.

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Respectfully submitted,

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